

Need/Opportunity Title: Down-Hole, Real-Time Monitoring of Radiation (Mainly Tritium) in Boreholes

Need/Opportunity ID No: NV01-0001-01S

Date:

Need/Opportunity Description: An instrument is needed to perform daily low-level radiation measurements in deep monitoring wells. Tritium is the principal radionuclide. Other needed measurements are temperature, pH, electrical conductivity, water level, and total gamma radiation. Current *in situ* instrumentation cannot achieve the performance specifications required to provide detection of small concentrations of tritium and other radionuclides in deep hydraulic systems.

Need/Opportunity Category: Science Need

Science Need Description: An instrument is needed which will maintain measurement sensitivity in a harsh, remote, down-hole environment. Current *in situ* instrumentation is either too large for down-hole use, unproven reliability (calibration stability), or insufficient detection limits. The impact of the geochemical composition of the groundwater on detection limits is uncertain. Another insufficiency of scientific knowledge is the inability to distinguish between solution concentrations and colloidal transport of contaminants other than tritium.

Operations/Field Office: DOE/NV

Site: Nevada Test Site

End User Program: Environmental Restoration Division (ERD)

Priority Rankings:

End User Program Ranking: 1 of 2

ACPC Priority: 2

Site Wide Ranking: 3 of 13

PBS Number/Title: NV212/Underground Test Areas

WBS Number: 1.4.1.2.1.2

Waste Stream: RAD Contaminated Groundwater (01209)

Background: Presently, large volumes of water are pumped from deep wells with either dedicated pumps, or pumps which must be installed for each sampling. The installation of pumps for each sampling requires a drill rig or similar equipment that is expensive to operate. This procedure requires considerable decontamination of equipment and disposal of contaminated water. Monitoring requirements are projected to continue for at least 100 years.

“Baseline” Technology/Process: Large volumes of water are pumped from deep wells with either dedicated pumps or pumps installed for each sampling. The installation of pumps for each sampling requires a drill rig or similar equipment that is expensive to operate. This currently used procedure requires considerable decontamination of equipment and disposal of contaminated water. Monitoring requirements are projected to continue for at least 100-years.

Cost: The conceptual cost estimate is \$244 million in present day dollars.

How Long Will it Take: One hundred years beginning in 2006.

Issues Related to Baseline:

Technical: Lack of accuracy in monitoring measurements.

Cost: \$158 million in present day dollars over a 100-year monitoring period.

Regulatory: Federal Facility Agreement and Consent Order with the state of Nevada requires monitoring.

Safety, Health, and the Environment: *In situ* monitoring reduces worker exposure.

Stakeholder and Cultural: Perceived risk is reduced as early detection is improved.

Other: None.

Need/Opportunity Description: An instrument that maintains measurement sensitivity in a harsh, remote, down-hole environment. Current *in situ* instrumentation cannot achieve the performance specifications required to provide detection of small concentrations of tritium and other radionuclides in deep hydraulic systems. The impact of the geochemical composition of groundwater on detection limits is uncertain. Another insufficiency of scientific knowledge is the inability to distinguish between solution concentrations and colloidal transport of contaminants other than tritium.

Functional Performance Requirements:

Outer Diameter: 1.75 inches

Remotely monitored

Depth of Placement: 800 to 5,000 feet

Hydrostatic Pressure: 0 to 1,800 psi

Temperature: 50° to 135° F

Duty Cycle: 50 years

Conventional Electricity: Unavailable

Resolution: 1,000 pCi/L (300 pCi/L preferable)

Accuracy: ± 10 percent

Range: 1,000 to 200,000 pCi/L

Frequency of Measurements: Daily

Additional Measurements: temperature, pH, electrical conductivity, water level, total gamma

Schedule Requirements: A deployable system beginning in 2002.

Consequences of Not Filling Need/Opportunity: Greater expense and risk of worker exposure during sampling and decontamination.

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